QUANTUM TECHNOLOGIES

A Cost-Effective Low-Emission Hydrogen-Powered Hybrid-Electric Vehicle.

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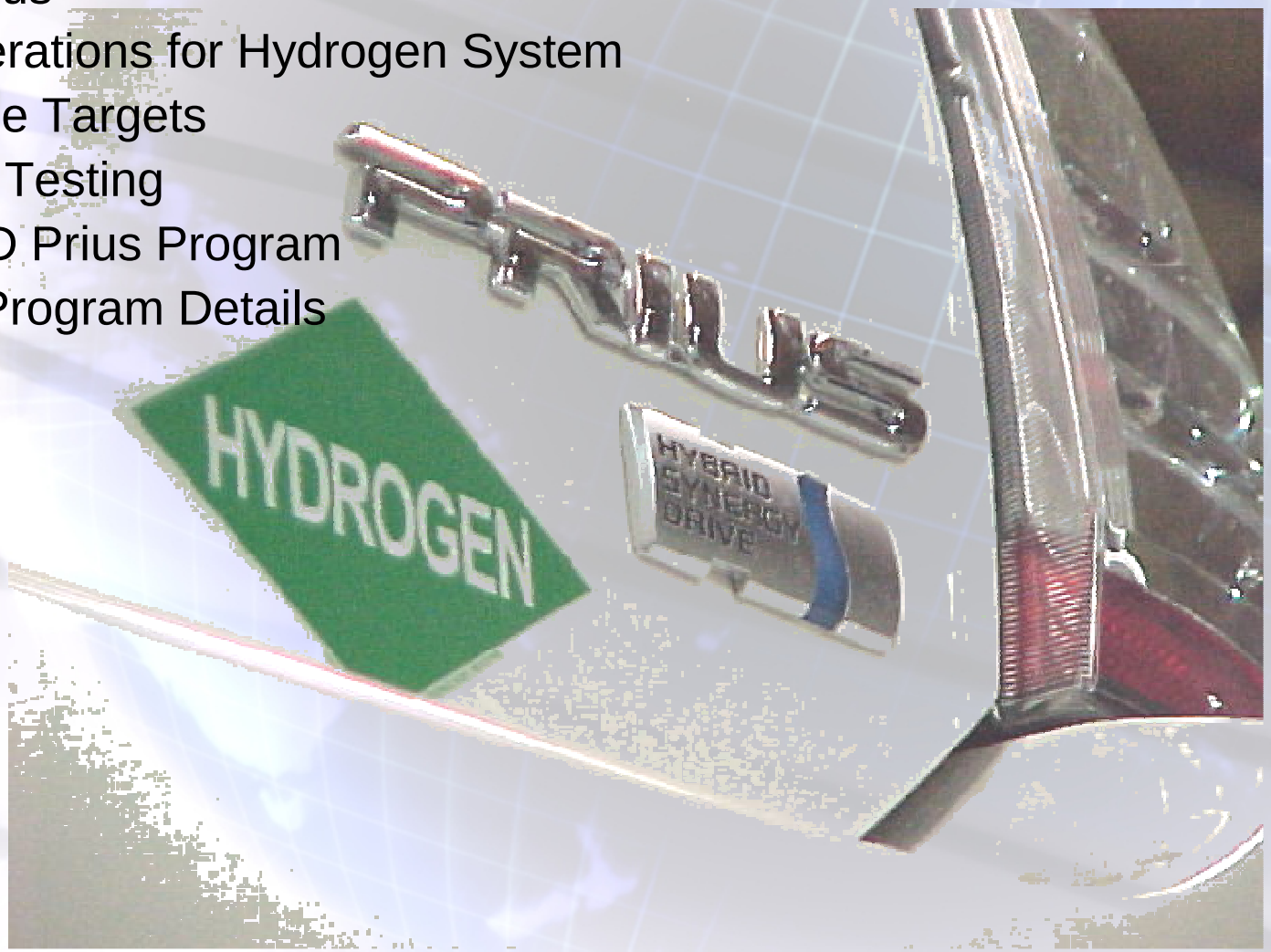
Overview

- Introduction to Quantum
- Program Justification
- Why the Prius
- Vehicle Alterations for Hydrogen System
- Performance Targets
- Verification Testing
- 2005 AQMD Prius Program
- Additional Program Details



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Corporate Overview

Over 45 Years of Gaseous Fuel Experience in Storage, Metering, & Electronic Controls:

- Transportation: Commercial & Military
- Power Generation
- Hydrogen Refueling Infrastructure

Largest Tier I Second Stage Manufacturer for GM

- Supplier of the Year in 1999
- Second Stage Manufacturing
- Powertrain Engineering
- Systems Integration
- Concept & Specialty Vehicles Development

Commercialization Partnerships

- GM: Worldwide
- Sumitomo: Japan
- IMPCO: Europe
- AM General: North America

700 Employees, 17 Facilities

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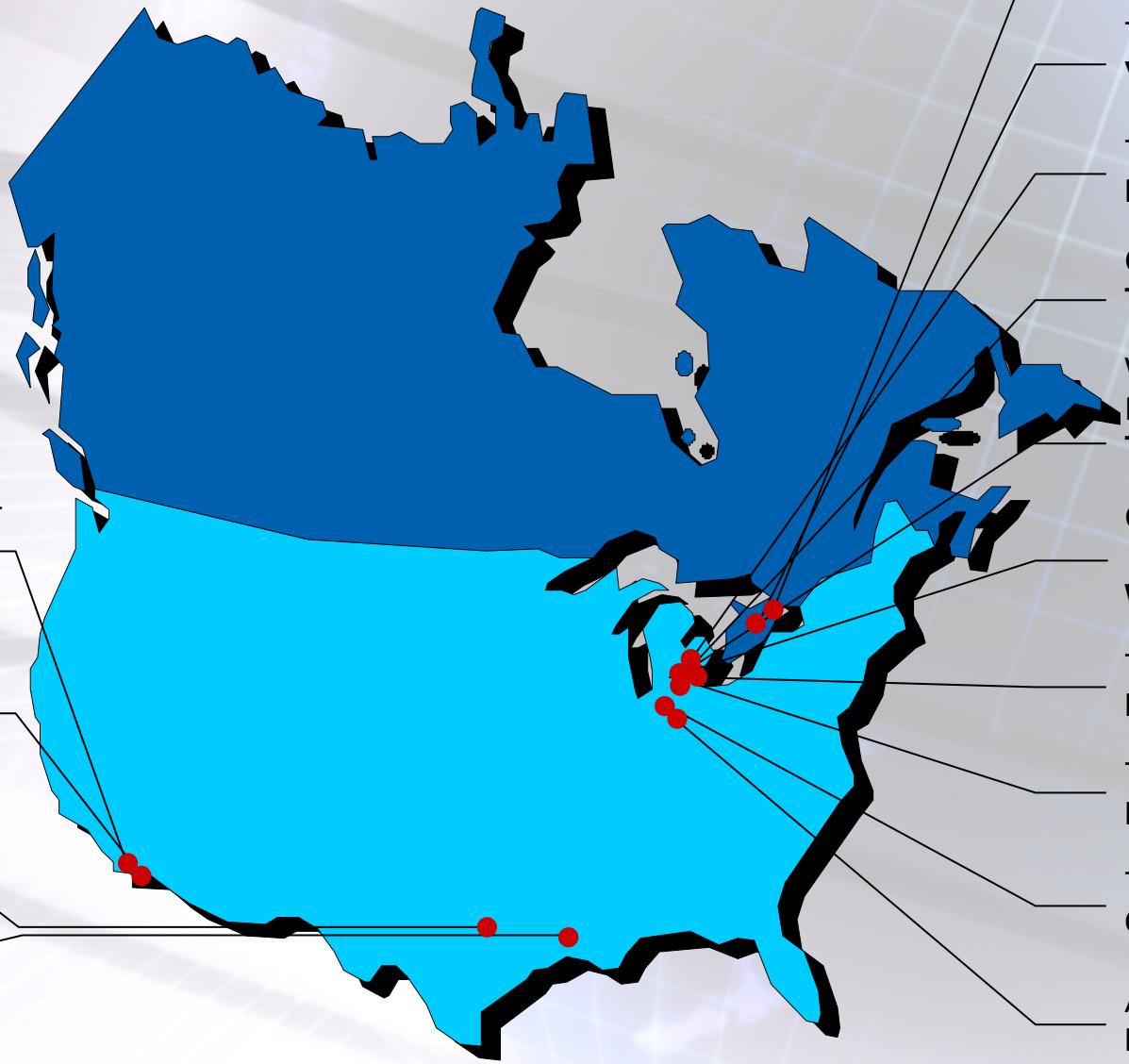
Plant Locations



Tecstar
Whitby, ONT

Tarxien
Vaughn, ONT

Troy Tooling
Rochester Hills, MI

Quantum Detroit Office
Troy, MI

Wheel to Wheel
Powertrain Integration
Troy, MI

Classic Design
Concepts
Walled Lake, MI

Tecstar Pgm Mgmt
Madison Heights, MI

Tecstar Distribution
Livonia, MI

Tecstar Finance
Goshen, IN

Amstar
Fort Wayne, IN

Corporate
Headquarters
Quantum Advanced
Technology Center
Irvine, CA

Quantum Advanced
Vehicles Center
Lake Forest, CA

Tecstar
Haslet, TX

Tecstar
Shreveport, LA

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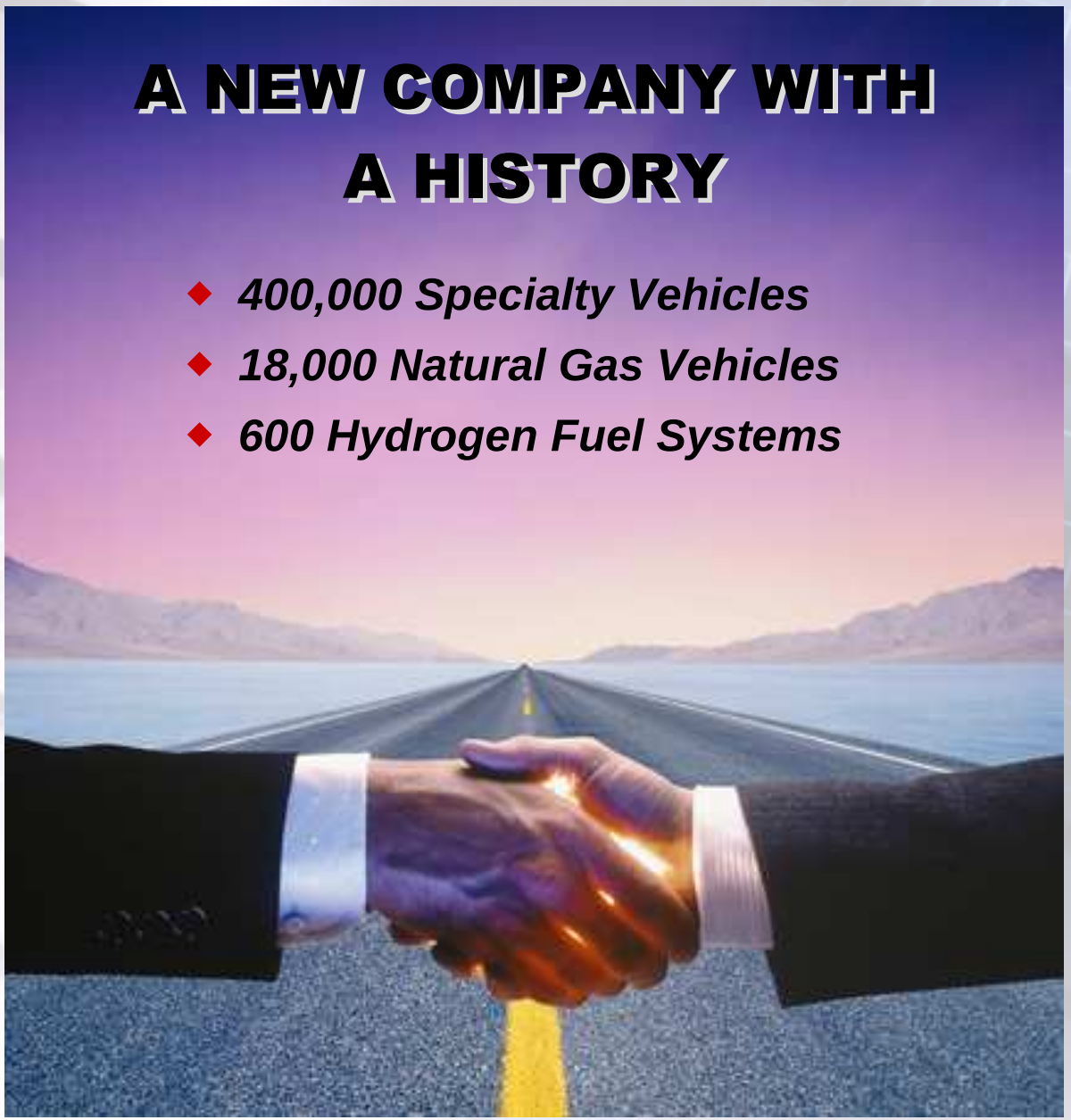
Tier One Experience



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Program Justification

- Hydrogen-fueled internal combustion engine (ICE) vehicles show promise as a bridge technology between conventional vehicles to fuel cell vehicles and have the potential to significantly reduce VOC, NO_x, CO and air toxic emissions as well as green house gas emissions.

- Hydrogen-fueled ICE vehicles would utilize the developing hydrogen infrastructure and help expedite the expansion of hydrogen infrastructure coast to coast.

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Why the Prius?

- Acquired Knowledge & Experience in a Previous Prius Program
- Prius Advantages
  - Hybrid Electric Powertrain
    - Electric Motor Acceleration Assist
    - Engine Shutdown at Idle
    - Regenerative Braking
    - Electric-Only Operating Mode
    - Battery Charging Controls
  - Efficient Power Plant
    - CVT Transmission
    - Engine & Control Functions
      - » Camshaft Position Control
      - » Electronic Throttle Position Control
- Technology Hurdles
  - Hydrogen Storage Capacity
    - Requires High Fuel Efficiency for Range
  - SULEV Emissions
    - Requires High Fuel Efficiency for Meeting Standard

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H_2Hybrid Characteristics

- Energy efficient drivetrain
- SULEV emissions with
  - VOCs, CO and CO_2 virtually eliminated
- Bridge technology to fuel cell vehicles
- Demand for hydrogen and infrastructure

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H_2Hybrid Characteristics Continued

- Performance comparable to gasoline version with increased fuel economy
- The H_2Hybrid includes:
  - Electronic multi-point hydrogen injection system using Quantum's hydrogen injector and engine controller
  - Turbocharger and inter-cooler for increased performance and efficiency
  - Quantum Compact light weight compressed hydrogen fuel storage module
  - Hydrogen fuel delivery system comprising of stainless steel tubing produced with our CNC fuel line equipment
  - FMVSS crashworthiness tested

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H_2Hybrid Specifications

Horsepower	70 HP at 4,500 rpm
Torque	82 lb-ft at 4,000 rpm
Fuel Consumption Rating	56-58 M/kg (FTP city test), real world 40 to 60 M/kg subject to driver and drive cycle
Fuel Capacity	1.6 kg at 5,000 psig / compressed 2.4 kg at 5,000 psig (extended range package)

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Vehicle Alterations Performed

Three-Dimensional scans were completed of the underbody to generate mathematical models, to facilitate the design and the integration of the hydrogen storage system

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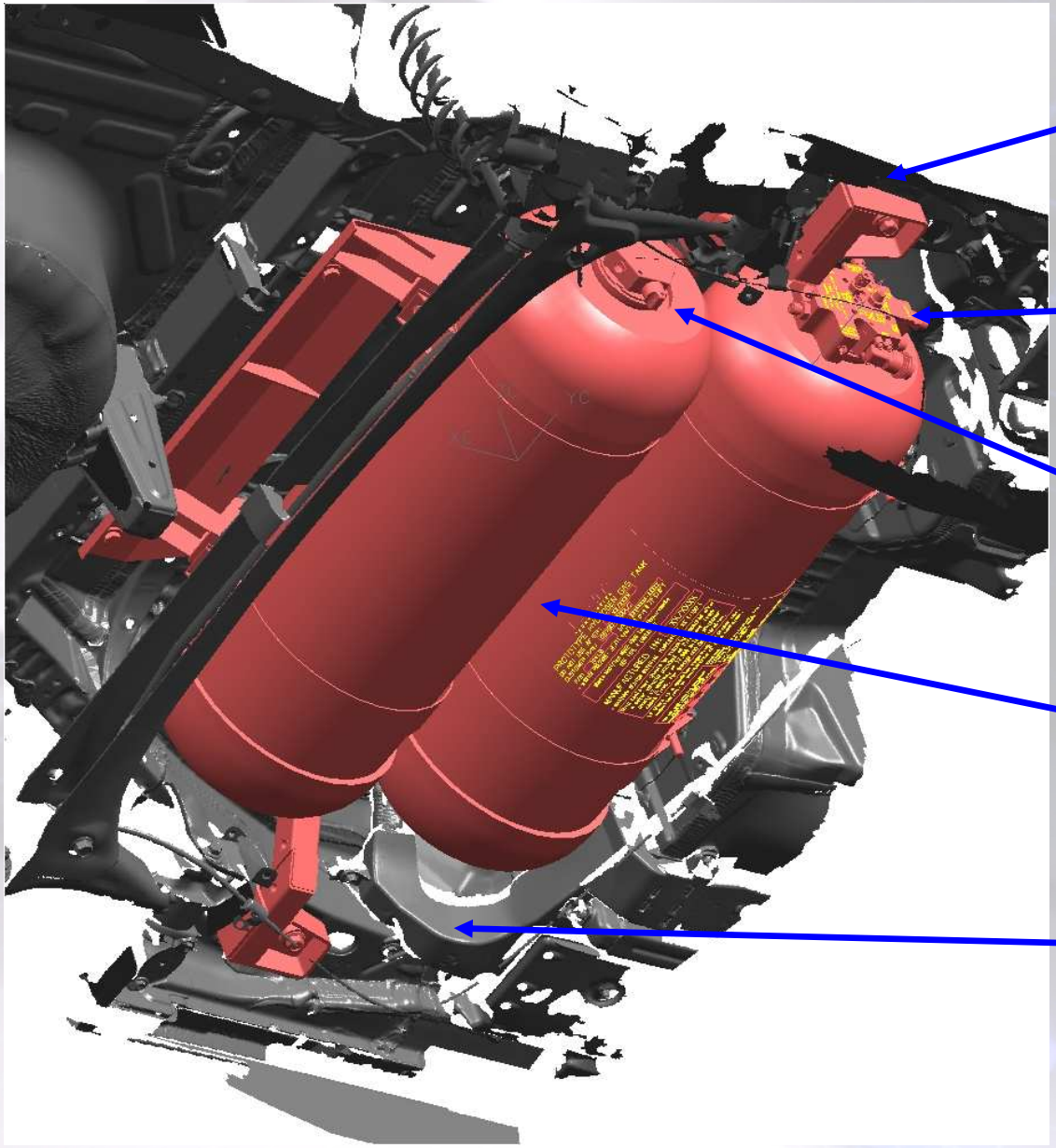
CAD Illustration of Hydrogen Storage System



Tank Support System

On-Tank Regulator

Tank Valve

Dual Tank System

Vehicle Underbody

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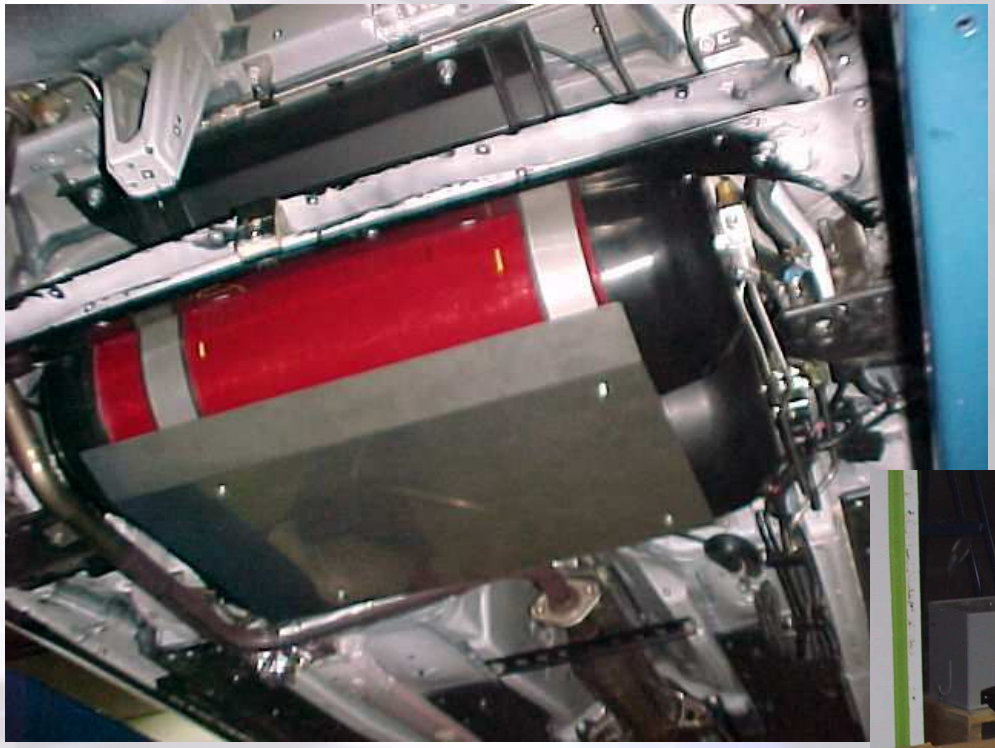
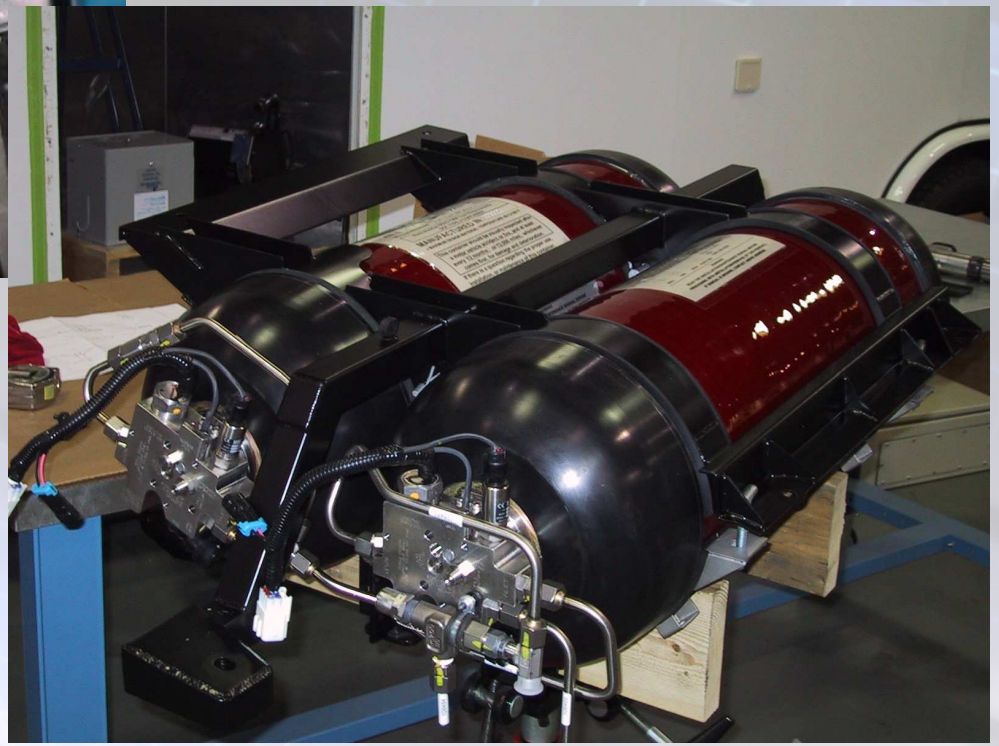
Actual Hydrogen Storage System Layout





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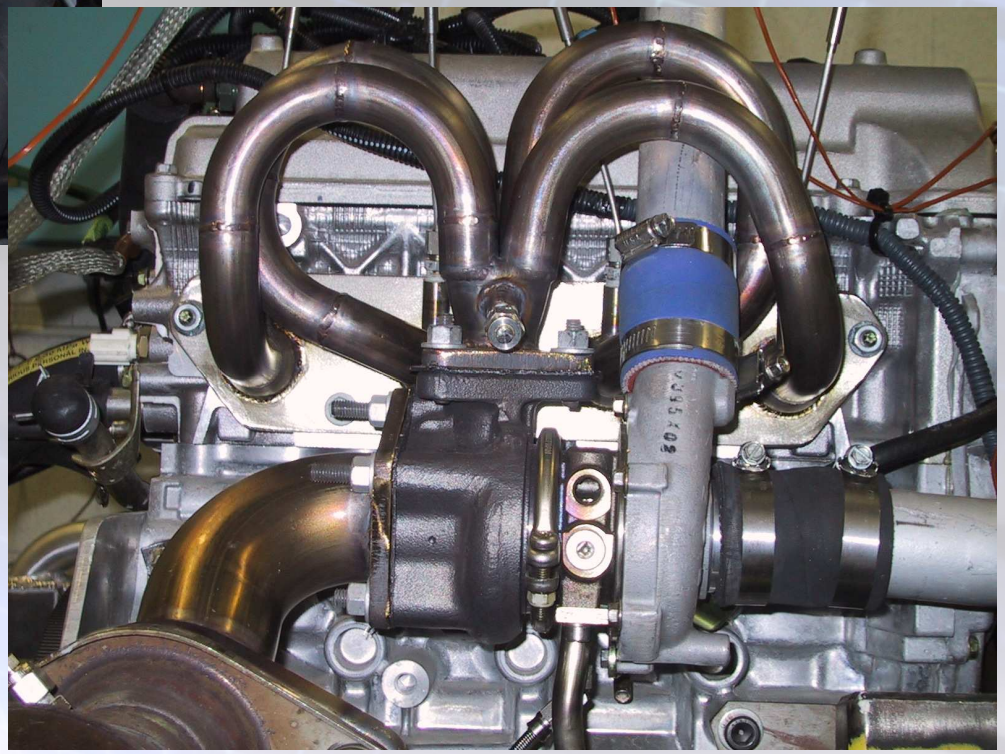
H_2Hybrid Engine Modifications



Base engine modifications include the addition of hydrogen fuel injection and associated controls, a turbocharger and an intercooler.

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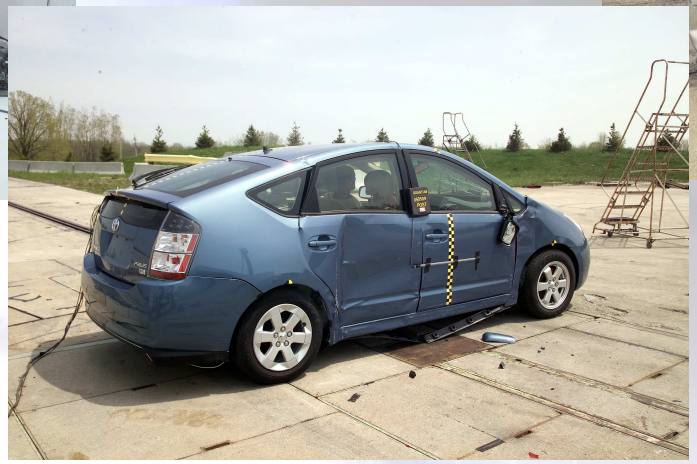
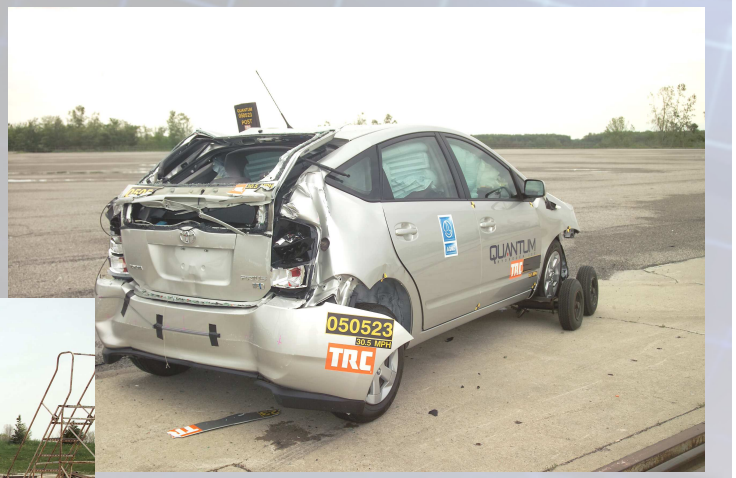
Results Barrier Testing

- No Current Federal Requirements Exist for Hydrogen Fueled Vehicles;
- Followed FMVSS 303 Guidelines for Compressed Natural Gas including Front, Rear Moving and Side Move barrier hits planned
- Status – All Impacts Completed Successfully





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Results Engine Verification Testing

- Engine Durability
  - 200 hour accumulation target
  - Status – Hours completed

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Results Vehicle Testing

- **Completed more than 15,000 miles mid August 2005**
- **Continuing Mileage Accumulation to Monitor Vehicle Performance and Experience Issues Prior to their Occurrence in Customer Vehicles**

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Status - Prius Build Program

- Seven Vehicles for Development and Validation Activities
  - Two for Engineering / Mockups
  - One for Mileage Accumulation and Durability Testing
  - Four for Barrier Crash Testing

- Thirty Nine Deliverables
  - Cities – 25 with compressed systems (5 per city)
  - AQMD – 5 with hydride systems
  - D.O.D. – 6 with compressed systems (*pending)
  - E-Vermont - 1 with compressed system
  - NYSERDA – 2 with compressed systems

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Additional Program Details

- **Next deliveries to customers planned for the first quarter of 2006.**

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